

CAPT Science Performance Task

Craters

When a meteor strikes the surface of a planet or a moon it may form a crater. There are many factors that may affect the size of the crater.

Your Task

Part I You and your partner will design and conduct an experiment to determine how the speed of a meteor (as influenced by the height dropped) affects the size of a crater.

Part II You and your partner will design and conduct an experiment to determine how a factor other than height affects the size of a crater.

During this activity you will work with a partner (or possibly two partners). However you must keep your own individual lab notes because after you finish you will work independently to write a lab report about your investigation.

You have been provided with the following materials and equipment. It may not be necessary to use all of the equipment that has been provided. You may use additional materials and equipment if they are available.

| | |
|--|--|
| 1 Bag of sand | 2 Small scoops of orange powder |
| 2 Trays (1 for carrying spheres) | 1 Plastic spoon |
| 3 Glass spheres (different masses) | 1 Meter stick (to measure drop height) |
| 3 Plastic spheres (different masses) | 1 15-cm ruler (to measure crater) |
| 3 Wooden spheres (different masses) | 1 Sheet paper (to place under tray with sand) |
| 2 Small plastic cups | Access to a balance |
| Safety goggles and apron for each student | |

CAPT Science Performance Task

Steps to Follow

1. **In your own words, clearly state the problem you are going to investigate for both Part I and Part II.** Include a clear identification of the independent and dependent variables that will be studied. Write your statement of the problem on pages 4 and 5.
2. **Design a separate experiment to solve each problem.** Your experimental designs should match the statement of the problem, should control for variables, and should be clearly described so that someone else could easily replicate your experiments. Include a control if appropriate.

Write your experimental designs on pages 4 and 5. Show your designs to your teacher before you begin your experiments.

To set up your experiments, place sand in a tray. To make the crater more visible, sprinkle a very thin layer of orange powder evenly on top of the sand. Smooth the sand and apply more orange powder before each trial.

3. **After receiving approval from your teacher, work with your partner to carry out your experiments.** Your teacher's approval does not necessarily mean that your teacher thinks your experiments are well designed. It simply means that in your teacher's judgment your experiments are not dangerous or likely to cause an unnecessary mess.
4. **While conducting your experiments, take notes on the attached pages.** Include the results of your experiments. Tables, charts, and/or graphs should be used where appropriate and should be properly labeled. Space for your notes and data is provided on pages 6 through 8.

Your notes will **not** be scored, but they will be helpful to you later as you work independently to write about your experiments and results. You must keep your own notes because you will not work with your partner when you write your lab report.

When you have finished, your teacher will give you instructions for clean up procedures, including proper disposal of all materials.

CAPT Experimentation Open-Ended Questions: *Craters*

Craters

Students in a science class carried out experiments to explore factors affecting the size of a crater.

Group A carried out the following experiment.

1. We think the height from which a sphere is dropped and the angle at which the sphere impacts the ground affects crater formation.
2. We selected a plastic sphere.
3. We then put sand into the tray and dropped the sphere, carefully removing the sphere from the sand after each trial.
4. We measured the diameter of the crater after each trial.

Our results are shown below.

| Height Dropped (cm) | Diameter of Crater (cm) |
|------------------------|----------------------------|
| 100 | 7.5 |
| 80 | 6.5 |
| 60 | 5.5 |
| 40 | 4.5 |
| 20 | 3.0 |

1. Group A's statement of the problem is, "We think the height from which a sphere is dropped and the angle at which the sphere impacts the ground affects crater formation." Is this a clear and complete statement of the problem that Group A studied? Explain fully why or why not.
2. Draw a line graph of Group A's results. The independent variable should be on the horizontal axis. Be sure to label your graph.
3. What conclusions can be drawn from Group A's experiment and results? How valid do you think these conclusions are? Explain your answer fully.

Craters (continued)

Group B carried out the following experiment.

1. We made the sand smooth so it was equally spread out and covered it with a thin layer of orange powder.
2. We measured the mass of all of the spheres.
3. We dropped the spheres and measured the size of the crater.
4. We measured the diameter of the crater after each trial.

Our results are shown below.

Crater Diameter

| Sphere | Large | Medium | Small |
|----------------|--------------|---------------|--------------|
| Wood | 2.1 cm | 1.5 cm | 1.1 cm |
| Plastic | 2.9 cm | 1.5 cm | 1.2 cm |
| Glass | 2.5 cm | 1.5 cm | 1.3 cm |

4. What, if anything, could Group B have done to improve their experiment? Explain fully.